

Kim, Dokyung; Kim, Seongcheol

Conference Paper

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22nd Biennial Conference of the International Telecommunications Society (ITS): "Beyond the Boundaries: Challenges for Business, Policy and Society", Seoul, Korea, 24th-27th June, 2018

Provided in Cooperation with:

International Telecommunications Society (ITS)

Suggested Citation: Kim, Dokyung; Kim, Seongcheol (2018) : An Institutional Analysis of Environmental Management in Korean Mobile Communications Industry, 22nd Biennial Conference of the International Telecommunications Society (ITS): "Beyond the Boundaries: Challenges for Business, Policy and Society", Seoul, Korea, 24th-27th June, 2018, International Telecommunications Society (ITS), Calgary

This Version is available at:

<http://hdl.handle.net/10419/190410>

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An Institutional Analysis of Environmental Management in Korean Mobile Communications Industry*

Dokyung Kim^a, Seongcheol Kim^{a,1}

^a School of Media and Communication, Korea University, South Korea

Abstract

This study focused on the environmental sustainability of the mobile communications industry (MCI). Environmental sustainability in MCI can affect not only corporates in the sector but also other industries by providing solutions to cope with environmental issues. Despite the significance of environmental sustainability in MCI, there has been lack of attention from prior researchers. This study investigated the environmental issues in MCI within the integrated and holistic approach to corporate sustainable management (CSM). In addition, the environmental management (EM) of mobile network operators (MNOs) was analyzed into the framework of the institutional theory. To investigate the environmental management (EM) of mobile network operators (MNOs), we carried out a case study on three Korean mobile communications companies (SK Telecom, KT, and LG Uplus). The result of this study showed that, in terms of environmental issues, economic and environmental issues were mostly found in the MCI, and the mobile communications firms have actively coped with the issues. The MNOs' EM was relatively active, and it was confirmed that regulatory, mimetic and normative mechanisms were

¹ Corresponding Author

Email addresses: addk@korea.ac.kr (D. Kim), hiddentrees@korea.ac.kr (S. Kim)

* Acknowledgment

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2016S1A3A2924760)

working simultaneously. The results of this study would provide some meaningful implications for practitioners as well as policymakers.

Keywords: Corporate sustainable management, Environmental sustainability, Environmental management, Environmental issues, Institutional theory, Mobile communications industry, Mobile network operators

1. Introduction

With climate change, solutions to environmental issues are most critical agenda around the world. There are efforts to solve the problems in the multiple dimensions from global to an individual. For example, leaders from 195 countries agreed with the reduction of greenhouse gases (GHGs) emission in 2015 Paris Agreement. People are changing daily habits to be eco-friendly and the number of green consumers is increasing (Young, Hwang, McDonald & Oates, 2010). In this context, business firms are also encouraged to reduce environmental impacts and join the environmental management (Ortas, Gallego-Alvarez, & Álvarez Etxeberría, 2015).

Environmental issues in business sectors are related to corporate sustainable management (CSM) which refers to management activities that support sustainable growth and increasing corporate values (Bansal, 2012). Corporates can achieve the CSM by simultaneous adoption of environmental, economic, and social contribution (Elkington, 1997). With rising of concern about environmental issues, however, environmental sustainability is regarded as a prerequisite to perform CSM (Goodland, 1995).

Despite importance of environmental sustainability, there are insufficient approaches to understanding the firm's efforts on environmental sustainability such as environmental management (EM). In addition, the scope of studies on EM is fairly narrow as many of previous studies have focused on manufacturing industry (Vachon & Klassen, 2008; Wagner, 2007). Therefore, this study seeks to expand the breadth of environmental issues and focus on how firms in other industries strive for EM.

The mobile communications industry (MCI) is an essential contributor to a country's

economic growth and social sustainability. The role of Mobile Network Operators (MNOs) are crucial as they provide the backbone infrastructure to communications development and deliver core services that enhance people's quality of life. Moreover, MNOs can provide solutions for environmental issues through saving energy and costs, to reducing GHGs emission by IoT service such as smart grid, smart home, smart office and so on. Ironically, on the other hands, the spread out of IoT services, which can contribute to environmental problems, is likely to deepen environmental problems in the MCI, such as the generation of GHGs from network equipment and an increase in electronic waste (E-waste). Even if MCI holds a key position in our society and closely related to environmental sustainability, EM in MCI has remained an under-researched area. Thus, this study is intended to focus on the environmental sustainability of MCI and analyze how MNOs cope with environmental issues.

This study has the goals as following. First, we will figure out the specific environmental issues in the MCI from the integrated CSM perspective. Second, this paper will analyze MNOs' EM through the isomorphism framework of the institutional theory. The result of this study will contribute to systematically examine the environmental issues that arise in the MCI from the holistic perspective of CSM. And it also will provide many practical and policy implications for the near future when the role of mobile communications will expand. We hope to provide a new guidance in preparing for environmental sustainability in the IoT era through this study.

The organization of this study is that section two reviews the studies of sustainability management and institutional theory. Section three outlines the methodology used. Section four describes the case of environmental management of three Korean mobile network operators. Section five discusses the case through the lens of institutional mechanism. Finally, section six presents the implications and the conclusion of this study.

2. Literature review

2.1 Corporate Sustainable Management (CSM)

In 1987, the World Commission on Environmental and Development (WCED) stated

the sustainable development in a report 'Our Common Future'. According to the WCED, "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987: 43). In other words, sustainable development is the promotion of human material utility or welfare while using resources at a level that can be preserved without damaging the natural environment (Pearce & Warford, 1993).

For the sustainable development, it needs to be satisfied economic responsibility, social equity and environmental integrity (Bansal, 2005). It means that in developing, not only pursuing economic effects but also considering social and environmental aspects from a future-oriented perspective. The sustainable development has made a change in perception of the role of businesses. The pursuit of economic profit was the most important objective of companies, but after the emergence of sustainable development perspective, social and environmental responsibility has become as important as economic benefits. The role of corporates has naturally changed to respond this expectation and Corporate Sustainability (CS) become a significant issue in academic and business fields (Kang, Ryu, & Kim, 2010; Montiel, 2008).

Corporate Sustainable Management (CSM) refers to strategic management activities to seek long-term survival and growth of the company by considering economic, environmental, and social performance in balance (Bansal, 2005; Gladwin, Kennelly & Krause, 1995; Salzmann, 2008). The economic sustainability is the fundamental profit-seeking activity of the company through improved profitability and creation of economic value of shareholders for continuous growth and survival (Bansal, 2005). The social sustainability is to practice the social responsibility which includes a contribution to social equality and maintenance of continuous partnerships with various stakeholders such as employees, suppliers, communities, and governments (Salzmann, 2008). Environmental sustainability means a contribution to environmental preservation through resource protection and eco-friendly management activities (Bansal, 2005).

CSM is a systematic and comprehensive perspective embraced diverse aspects (Tanzil & Beloff, 2006). Elkington (1997) suggested that a triple bottom line (TBL) composed of economic, social, and environmental (ESE) attributes creates a basic structure for

sustainable management. The three pillars of TBL are interdependent and collaborate simultaneously. CSM can be achieved through the harmony and integration of all three dimensions (Azapagic, 2003; Morrison-Saunders & Therivel, 2006). Therefore, the discrete approach is not enough to show the effect of interactions between different sphere. Integrated perspective is needed to have a better understanding of the interrelations for CSM.

2.2 Environmental Management (EM)

Among the three pillars of TBL, a significance of environmental sphere has been escalated with the rising concern about environmental issues. Since the 1990s, when industrialization had reached a stabilization period, corporate activities for environmental sustainability have been actively carried out and evolved into the form of environmental management (EM) (Berry & Rondinelli, 1998; Montiel, 2008).

EM aims to promote sustainable development of a company while considering problems such as damage and depletion of natural resources and environmental pollution caused inevitably by the company's unique manufacture and service activities (Gray & Bebbington, 2001; North, 1997). Companies can not only improve profitability by participating in EM but also create competitive advantage through active attitudes toward society and environment (Berry & Rondinelli, 1998; Chrismann, 2000; Porter & Linde, 1995b). For example, companies can achieve more economic benefits than their initial investment costs from the perspective of long-term, even if they have an early stage investment to build green facilities or implement EM. These EM activities contribute to the company's low-cost advantage and future competitiveness, which will ultimately improve the company's competitive advantage (Hart, 1995). In addition, the company can respond to diverse stakeholders who are requiring the corporate social responsibility by practicing EM. Thus, environmental sustainability is a prerequisite for achieving CSM (Goodland, 1995) and EM is a significant strategy to perform CSM.

Although the previous studies on environmental sustainability and EM have been actively carried out, the scope of the research is very narrow. Literature has mainly focused on manufacturing industry where is directly related to environmental pollution

compared to other industries (Vachon & Klassen, 2008; Wagner, 2007; Yang et al., 2010). It is necessary to expand the scope of research because environmental sustainability or EM challenge is not limited to one industry and important value to every company should pursue. Mobile communications sector has been long neglected by previous researchers in terms of environment. However, mobile communication industry occupies the most important position in modern society and is closely related to our life. Mobile network operators (MNOs) cannot be also free from environmental responsibility. Therefore, this study focusses on EM in the mobile communications field.

2.2.1 EM in Mobile Communications Industry (MCI)

Mobile Communications Industry (MCI) plays a significant role in modern society. Mobile communications can contribute to operate functions of individual and society facilitate as the central nervous system (Moss, Kaufman, & Townsend, 2006). For example, mobile communications services are essential to communicate with persons, to gather and distribute information, and to perform business functions (Kang et al., 2010). Without mobile communications services, individual and organization would be difficult to discharge their function. Therefore, MCI is the basis for sustainable society and daily life and its sustainability is the noteworthy issue.

In addition, MCI can provide innovative solutions to protect the environment and to preserve natural resources through the internet of things (IoT) service. Smart grid services, for example, can be a way to reduce energy use and costs. It also decreases GHGs emission by measuring and adjusting energy use to increase efficiency in real time. In the industrial sector, energy management systems will increase energy efficiency and moderate GHGs emission by measuring and controlling energy use at factories or buildings in real time. Like this, a variety of IoT service by Mobile Network Operators (MNOs) can provide the enhancement of environmental sustainability and effective EM practice.

On the other hands, environmental issues in MCI will rise rapidly with pervasion in the IoT era. For instance, E-wastes would expand as more things will connect to mobile communications, and GHGs emission for use of IoT services would be escalated. In this

context, the MNOs' environmental responsibility will be intensified to deal with discarded communication equipment or mobile devices and to reduce GHGs releasing from network equipment (International Telecommunication Union: ITU, 2017).

Despite the importance and connection with environmental sustainability of MCI, EM in MCI has remained under-researched because most industry-specific EM studies have focused on other industries such as manufacturing. As mentioned above, sustainable environment and mobile communications are inseparable both directly and indirectly and it can be the foundation to reduce degradation of an environment (ITU, n. d). Thus, this study will focus on environmental sustainability and EM challenge in MCI.

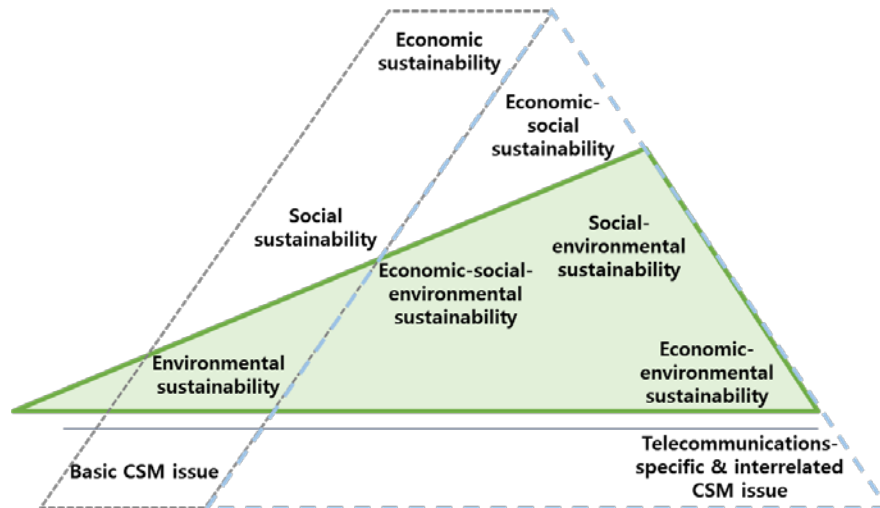


Figure 1. CSM framework for telecommunications service

* Source: Kang et al., (2010). “Exploring sustainability management for telecommunications service: A case study of two Korean companies.” *Journal of World Business*, 45(1), p.418. revised.

Corporate sustainability should be considered holistically along with the integrated perspective on TBL to have a better understanding. In the prior study of CSM for MCI, Kang et al., (2010) proposed an integrated way of perceiving the three dimensions by naming them as economic-environmental sustainability, social-environmental sustainability, economic-social-environmental sustainability. This approach is effective to reflect on the interrelationships of TBL in a complex business environment. To investigate EM in MCI, this study will identify environmental issues in MCI based on the holistic

approach. We propose the following research question.

RQ1: What are the environmental issues in the MCI?

2.2 Institutional Theory

While the institutional theory has multiple roots and variants, it attempts to explore organizational change on behavior and structure based on the social environment (Clemens & Cook, 1999; Hu & Huang, 2006; Meyer & Rowan, 1977). An institution refers to the social role and cultural pressures assigned to organizations (Scott, 2001). Institutionalization can be described as the process by which social expectations of an organization's legitimate and appropriate actions are established as acceptable actions and rules in society (Martinez & Dacin, 1999). According to the institutional theory, all organizations in a similar environment become isomorphism for organizational legitimacy and viability in a socially recognized form (DiMaggio and Powell, 1983; Scott, 2005).

DiMaggio and Powell (1983) proposed three institutional mechanisms to explain organizational change through the influence of socio-cultural factors; 1) regulatory/coercive, 2) mimetic/cognitive, and 3) normative. These three mechanisms are central causes of isomorphism and three factors strongly influence managerial decisions (DiMaggio & Powell, 1983). The regulatory/coercive mechanism is one of the motives of isomorphism of an organization, stems from pressure outside the organization (DiMaggio & Powell, 1983).

The regulatory/coercive pressure arises from not only informal pressures such as cultural expectations shared by society, but also the official pressures posed by governments, nations and other organizations on which the organization depends, such as government regulations, legal constraints or political influence (Delmas & Toffel, 2004; DiMaggio & Powell, 1983; Kim et al., 2009). For instance, companies have engaged the Emission Trading System (ETS) to comply with government environmental regulatory pressures. The mimetic/cognitive process is to mimic the organization that is recognized or successfully evaluated for justification (DiMaggio & Powell, 1983).

The mimetic/cognitive mechanism is internal response to cope with the uncertain environment, in contrary to regulatory/coercive pressure from an external organization (Bansal, 2005; Hu & Huang, 2006; Kim et al., 2009). For example, Tingling and Parent (2002) reported that when a corporate enter new markets, they imitate the largest and more profitable firms than those with similar conditions for viability in an uncertain environment. This is the mimetic isomorphism of corporates to survive in uncertain environments.

The normative mechanism is based on prevalent norms in the environment where the organization belongs (Kim et al., 2009). Social norms are mainly created and reinforced by formal education, the behavior of professional organizations, and media (DiMaggio & Powell, 1983). Organizations accept a structure justified normatively in their communities as a result of a normative isomorphism. For the normative justification, companies sometimes practice management activities based on industry norms rather than profit-making perspectives (Kim et al., 2009).

While these three mechanisms are theoretically distinguishable, it is hard to distinct strictly in practice because two or more of them are working simultaneously (Hu & Huang, 2006; Mizruchi & Fein, 1999). Nevertheless, the isomorphism mechanisms of the institutional theory have been widely used because it provides meaningful implications for understanding the change of organization.

Institutional theory has utilized to analyze CSM activities in literature. Bansal (2005) reported that mimicry and normative mechanisms of institutional theory influence on corporate sustainable development. Hoffman (1999) analyzed environmentalism in the U.S. chemical industry based on the institutional framework. Delmas and Toffel (2004) also adopted the theory in a study to understand environmental management practices. The prior studies showed that the institutional theory is apt to investigate MNOs' environmental management cope with environmental issues in MCI. Thus, we adopt the lens of the three institutional pillars to answer following research question.

RQ2: What mechanisms are effective in implementing environmental management in the MCI?

3. Research Method

The research method of this study is a case study. This method has the advantage of deriving comprehensive implications from a multiple analysis (Yin, 2013). This study is based on three MNOs' cases of Korean MCI where highly developed the mobile communications system. Since Korean MNOs, SK Telecom (SKT), KT and LG Uplus (LGU+), are not free from environmental responsibility as corporate citizens, they have been continuously making efforts and set up governance for EM. Therefore, it is expected that Korean MNOs' EM activities will provide useful insight for the understanding uniqueness of EM in MCI.

Data were collected from interviews and secondary sources. The interview was conducted on May 14 and 16, 2018, to the EM staffs of SKT and KT, and CSR staff of LGU+, for about an hour per each person. From the interviews, we collected information on each company's EM policies and specific methods. In addition, we investigated secondary sources included MNOs' annual reports published between 2011 to 2016, firms' websites and news articles. Recorded documents can provide useful insights as well as useful pieces of evidence to support the information gained from interviews (Yin, 2003).

The collected data were analyzed through an integrated and holistic CSM approach and the isomorphism of institutional theory. Environmental issues arising from the MCI are relatively complex and new, so the integrated view, considering the interconnectivity of three aspects of CSM, is appropriate (Kang et al., 2010). In addition, EM is highly influenced by regulatory and social pressures. Hence it is necessary to analyze with a comprehensive perspective that considers the coercive, norms, and response to uncertainties (mimetic). In this respect, isomorphism of institutional theory is a suitable framework for analyzing the MNOs EM.

4. Case study: Environment management of Korea mobile network operators

4.1 Profiles of SKT, KT, and LGU+

Major companies of the Korean MCI are SKT, KT, and LGU+. SKT and LGU+ are subsidiaries of SK Group and LG Group and they are greatly influenced by their parent

companies. The two parent companies are the leaders in the top five in terms of economic and industrial in Korea, and they are also actively involved in sustainable management (Korea Fair Trade Commission; KFTC, 2017). In contrast, KT, which started as a state-run company, grew into a large corporation with many subsidiaries along with the growth of the Korean telecom industry. As of 2017, KT ranked 12th in the Korean business sector (KFTC, 2017).

SKT is a leading mobile network operator and it has almost 50% market share. As of 2016, its mobile communications services are operated simultaneously from 2G to 4G. It is the first operator to offer mobile-phone services and has been in business since 1984. After the privatization, the company was incorporated into a subsidiary of SK Group, which has achieved the present to its remarkable growth.

KT is the nation's No. 1 fixed-line operator and started its business in 1981. In 2009, it merged with its affiliate KTF, which operates the mobile-phone service business, to become an integrated operator providing both wired and wireless services. KT offers 3G and 4G mobile communications services, with its market share reaching about 26% in 2016.

LGU+ is a latecomer of wireless communications in Korea and is an affiliate of LG Group. In 1996, LG Telecom acquired LG Dacom and its subsidiary, LG Powercom, to become a third-party carrier. The company provides second and fourth generation mobile communications services and has a market share of about 20 % as of 2016. Table 1. shows that summary of the three Korean MNOs' profiles.

Table 1. Profiles of Korean Mobile Network Operators

(Unit: KRW billion, person)

	SK Telecom	KT	LGU+
Establishment	March 1984	December 1981	July 1996
Business Area	Communication-services (mainly mobile communications)	Communication-services (mainly fixed-line and mobile communications)	Communication-services (mainly mobile communications)
# of subscribers	29,590,000	18,892,000	12,490,000
Revenue*	17,092	7,418	11,451

# of domestic employees*	4,399	19,436	6,694
Publishing year of 1 st environmental report	2006	2006	2011
Environment Management Vision	Green Culture, Green Process, Green Product	Carbon impact 2020	Green 2020

* Items are based on the year 2016.

4.2. Environmental Issues in MCI

This study investigated environmental issues arising from the MCI by analyzing environmental management activities of MNOs in Korea. Environmental issues in the MCI were classified as an integrated CSM approach, and this result will be the answer to research question 1: What are the environmental issues in the MCI?

4.2.1. Environmental and Economic Issues

Environmental and economic issues were classified that related to create economic benefits as well as protect the environment. Environmental and economic issues arising from MCI were the emission of GHGs to use network equipment, investment in eco-friendly new technologies and IoT services, issue mobile communications service bills and membership cards, foster an eco-friendly office environment.

The emission of GHGs to use network equipment

GHGs problems caused using communications equipment can be classified into environmental and economic issues. Network equipment is an essential element to provide services and continue MNOs' business. Moreover, GHGs emission from the equipment also make MNOs have an economic burden to purchase Certified Emission Reductions (CERs). EM managers of the MNOs also pointed out that the emission of GHGs to use network equipment is the most critical environmental issues in the MCI. Amount of releasing GHGs generated from Global MCI will be 235 MtCO_{2e} by 2020 and this is a third of the annual GHGs emission across the UK (Fehske et al., 2011). GHGs emission from communication equipment are expected to increase further with the

proliferation of IoT services. Thus, it may be a crucial to MNOs for improving network efficiency.

EM staffs argued that their corporates have persistent efforted in eco-friendly network facilities. For example, MNOs have been working to reduce the number of devices by improving the efficiency of network equipment. To decrease the number of network devices, they have integrated equipment through reorganize network structure and have replaced low-efficiency equipment with high-efficiency apparatus.

In the same vein, KT and LGU+, which operate their own data centers, also have attempted to establish eco-friendly data centers. For data center operation, a lot of heat is generated for the use of electricity and considerable energy is needed to cool the heat. Both companies have implemented energy-efficiency systems such as an outdoor air intake system to reduce the energy needed for cooling and to shrink GHGs and resource.

Invest in eco-friendly new technologies and IoT services

Investment in eco-friendly new technologies and invention of new services such as the Internet of Things (IoT) relates to environmental and economic sustainability in MCI. IoT services are the new business model that can be a driving force of MNOs to generate economic profits in the saturated MCI. Also, environmental benefits can be expected by maximizing energy efficiency or reducing GHGs emission through new services that are integrated with ICT technologies. For this reason, MNOs have considered investment in green technologies and related service development as an important issue for their CSM.

To create new businesses and improve the environment, MNOs have invested in low-power short-range technologies such as Z-Wave and ZigBee, Bluetooth and Wi-Fi to provide smart home services or smart bin and so on. They have also focused on developing low power wide area (LPWA) technologies for NB-IoT (Narrow Band IoT) service. SKT's LoRa (Long Range) and LTE-M technologies, jointly adopted by the three companies, have the advantage of reaching farther away with low power. These low-power technologies can decrease energy consumption and LPWA technologies provide services to a wider area with fewer devices, which can contribute to reduce the emission of GHGs due to communications equipment (Kim, 2016. 12. 7).

The three firms have operated Building Energy Management System (BEMS) and Factory Energy Management System (FEMS), to industrial sites and office buildings where energy consumption and GHGs emission are high. These services, a kind of smart grid, provide advantages to increase energy efficiency and decrease emitting GHGs by measuring and adjusting energy consumption in real time. SKT has provided a Lighting Energy Management System (LEMS) service that can save energy by monitoring power consumption and adjusting an intensity of illumination in real time. KT has operated Renewable Energy Management Systems (REMS) that effectively manages solar and geothermal energy. KT has also actively prosecuted for the diversification of energy. LGU+ has offered Remote Management Solution for Smart Pipe Networks that monitor and prevent water and gas leakage.

All MNOs have provided smart home services to enhance the energy efficiency of lighting, home appliances, and gas usage. Their smart home services can check and control the use of electrical plugs, switches, home appliances and gas in real time. Furthermore, SKT and LGU+ have offered a total system to establish the smart home environment in cooperation with home appliance makers, interior designer, and apartment construction companies. Home IoT service of LGU+ can measure the amount of energy collected on solar panels installed in homes.

The MNOs have also efforded in developing and invention various IoT services such as smart cities and smart logistics to create new revenue sources and improve environmental problems.

Issue mobile communications service bills and membership cards

Issuing mobile communications service bill and membership card is environmental and economic issues for MNOs. Mobile communications service fees are the main revenue source for MNOs, and the operators have issued monthly billing for all subscription lines. Paper bill is a waste of resources and degradation of an environment and a huge economic burden for MNOs. Specifically, three MNOs spent money more than 350 billion won on issuing paper billing for 5 years (2011-2015) (Seo, 2016. 8. 16). MNOs also issue membership cards to provide benefits to service users. Like paper billing, the plastic membership cards cause environmental and economic problems in MCI.

To reduce waste of resources and costs, the three companies have encouraged customers switching to an electronic or mobile bill and mobile membership card. In 2016, about 22 million users of SKT (84% of total subscribers) use electronic or mobile smart bill. The conversion rate of KT and LGU+ has also increased steadily since 2011. LGU+ has conducted a campaign ‘Love Delivered through Bill’ from 2011 to induce customers to switch e-bills. ‘Love Delivered through Bill’ is an activity to donate the costs saved by e-billing for children with incurable diseases. The MNO has donated approximately 570 million KRW to a total of 79 patients (as of 2016). Through this campaign, LGU+ was able to shrink the number of paper bills by 3.67 million per month in 2016 alone and help to protect the environment.

As the penetration rate of smartphones raised, the replacement rate of mobile membership card increased. MNOs would save the costs and resources required to issue plastic membership cards. According to SKT (2016), it is expected that the use of mobile membership card will result in saving 4.88 grams of plastic per customer and reducing 12 grams of carbon emission from being emitted. This is equal to reducing the use of four A4 size pieces of paper or contributing the volume of oxygen from 40 pine trees.

Foster an eco-friendly office environment

All MNOs have made efforts to create a green workplace what save the resource and costs. For example, SKT, KT, and LGU+ introduced an outdoor air intake system to reduce the energy needed for cooling. And they have tried to shrink paper use, decrease of waste emission in office buildings, use water-saving faucets, recycle rainwater, replace with LED lighting and high-efficiency appliances.

Moreover, KT and LGU+ have used renewable energy such as solar energy or geothermal energy for low GHGs releasing and high energy efficiency. LGU+ has built solar self-generation systems within its buildings in Daejeon, Paju, and Yongsan. KT has used geothermal energy for heating, cooling and supplying hot water to reduce costs and usage of fossil fuels. KT has converting gradually its business vehicles into electric vehicles.

4.2.2. Environmental and Social Issues

Environmental and social issues relate to MNOs' environmental and social sustainability. In detailed, these are issues on the emission of social GHGs and MNOs' efforts to improve.

Efforts to reduce social GHGs emission

MNOs have expanded the scope of managing indirect GHGs emission through research to reduce social GHGs emission and offering environmental solutions. Managing social GHGs refers to using the ICT services MNOs possesses to reduce the GHGs emission that result from the activities of daily life.

To reduce social GHGs releasing, the three MNOs have provided navigation services. SKT has operated T map navigation and has as many users as the oldest. KT provided Olleh Navigation and LGU+ Cloud Navigation Service respectively, but they have launched ONE NAVI jointly produced in 2017. These navigation services help reduce the use of fossil fuels and the generation of GHGs by providing the shortest time and shortest distance directions through real-time traffic information gathering.

According to SKT (2016), T map provided the shortest distance information reflecting the traffic situation on the road, contributing to the use of fossil fuels due to social greenhouse gas generation and vehicle operation. As of 2016, the annual GHGs emission from T Map Navigation are estimated to reach 42.4 tons. The method for calculating the reduction of greenhouse gas with SKT's T map navigation was also recognized as an international standard for ITU (International Telecommunication Union, ITU).

4.2.3. Environmental, Social and Economic Issues

Environmental, social and economic issues is most complex due to interrelated with environmental sustainability, social sustainability, and economic sustainability in the field of MCI. Based on the MNOs' EM, we identified several issues that disposal of electronic wastes (E-wastes) and generating electromagnetic waves from network equipment and devices.

Disposal of E-wastes

The amount of discarded electronic devices is increasing day by day. In particular, mobile phones with short replacement cycles are a major cause of rising of electronic waste. The literature reported that heavy metals such as lead and cadmium in discarded mobile phones produce toxic substances, causing serious damage to the human body, including hearing loss (Liu et al., 2018). E-waste causes economic losses in terms of resource waste as well as environmental and social problems related to people's health. Thus, it can be categorized into environmental, social and economic issues.

Since 2005, MNOs have begun to pay attention to E-wastes disposal. The MNOs participated in the Mobile Recycle Korea (MRK) campaign led by the Ministry of Environment at that time. The Extended Producer Responsibility (EPR) policy, which gives MNOs legal obligation to dispose of used mobile phones and network equipment, was also implemented in 2005 (Ministry of Environment, 2005. 9. 20). MNOs are required from the Ministry of Environment to achieve the given recovery rate of discarded mobile phones every year. However, the practitioners said that due to the nature of the mobile handset distribution structure in Korea, the achievement of the waste cell phone collection ratio goal is left to the autonomy of the business rather than coercion.

The three MNOs have actively engaged through diverse campaigns in the collection of E-wastes such as mobile devices and donated the revenue from collection of used phones (used phone sales or resource sales) for underprivileged people. Among the MNOs, SKT's activities have especially outstood. SKT established the Happy Eco Phone Foundation in 2013, which collects used mobile phones and resells them as refurbished phones after repair. The foundation is a social enterprise that has hired vulnerable groups. It has been operated with proceeds from sales of refurbished phones and used phones and it has profitable. In addition, it is a proper way to solve dangerous substances of heavy metal in E-wastes and recycle resources. As a result, SKT has achieved the integrated CSM in terms of disposal of E-wastes through the happy eco-phone foundation.

Generate Electromagnetic Wave from network equipment and devices

Electromagnetic waves (EW) are generated by communications equipment such as base stations, relays and cell phones. Social awareness that EW is dangers is spreading, as the World Health Organization (WHO) defined EW as harmful materials (International

Agency of Research Cancer: IARC in WHO, 2011. 5. 31). Moreover, there has been a NIMBY (Not in My Back Yard) phenomenon that ordinary citizens refuse to install communications relay or antenna in their area due to concern about dangerous of EW. EW issues are not only related to the business sustainability of MNOs but also to environmental and social issues needed MNOs active responses.

SKT and KT have measured the EW of their communications equipment and releasing relevant information in a sustainability report. SKT and KT have invested in research and development related to the absorption rate of EW in the human body. Although LGU+ was not included in their efforts for EW in the report, we could find the information on the company's website. In addition, all EM staffs said that they have gone through a preliminary consent process by collecting opinions from relevant stakeholders when installing a new transmitting antenna. As a result, all MNOs have continued their efforts for eco-friendly and safe wireless communication services.

4.2.4. Environmental Communications Issues

SKT, KT, and LGU+ have operated environmental governance and communicated with stakeholders to practice their environmental management. The three companies have conducted environmental education and afforestation projects for internal employees. SKT and KT obtained ISO 14001, an international standard for the environment, and provided compulsory in-house education in accordance with its policy. LGU+ has participated in a related forum in accordance with the LG Group's environmental vision of Green 2020 to share environmental management know-how among its affiliates.

The three MNOs also have supported environmental education and management for partner companies. KT has supported partner companies to acquire ISO 14001, which is an environmental international certification. LGU+ has provided green consulting such as carbon management systems and energy management systems to business partners. And the firm has supported that the partners obtain certifications such as Green Certification System.

Figure 2 showed the summary of environmental issues in MCI.

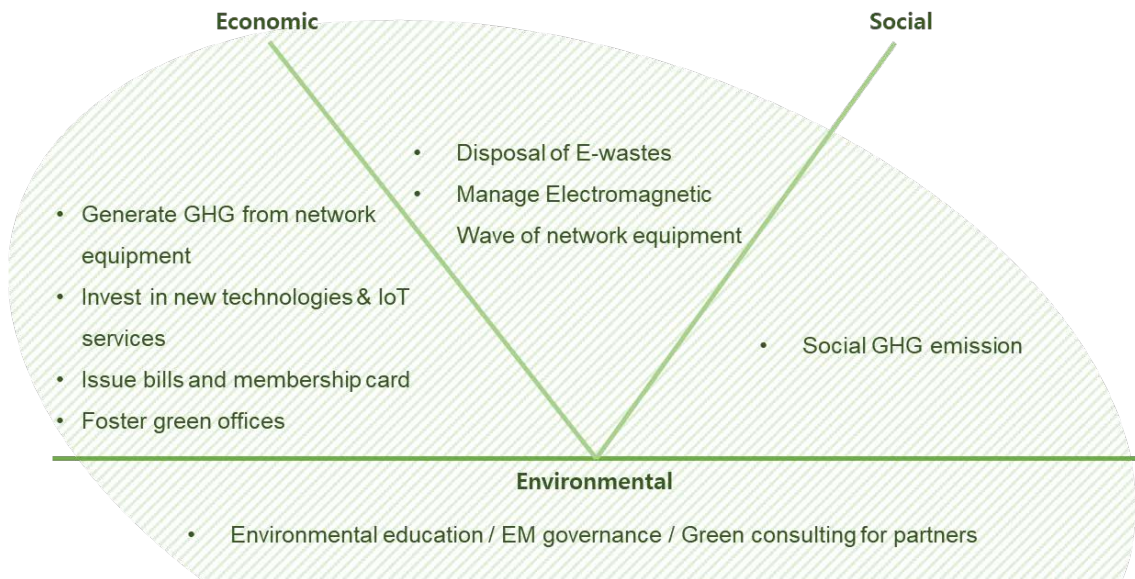


Figure 2. Environmental Issues in MCI

5. Discussion

To find the answer to research question 2, we analyzed Korean MNOs' EM into the isomorphic mechanism of institutional theory. The result of this analysis showed institutional initiatives for EM in MCI.

5.1 Coercive and Regulatory Mechanism

The regulatory mechanism is based on political or legislative influences (DiMaggio & Powell, 1983; Kim et al., 2009). Regulatory mechanism is the pressure comes from outside the organization, and companies are affected not only by domestic but also by global trends. Since environmental regulations and related laws are applied relatively strictly, companies are active in dealing with them.

For example, 195 nations signed an agreement to cut GHGs emission at the 21st Conference of the Parties (COP 21) of the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015. According to this Paris Agreement, Korea participated with a target of 37% reduction in GHGs emission compared to the

estimated GHGs emission in 2030 (UN FCCC, 2015). To accomplish the goal, corporates in Korea should engage in the endeavor to reduce GHGs emission. In the same vein, Korea has been implementing the GHGs and energy target management system since 2010 under the Framework Act on Low Carbon Green Growth. Based on the law, the three MNOs have had the legal responsibility to control an amount of releasing GHGs engendered from network equipment. They also have complied with Emission Trading Scheme (ETS).

Environmental managers of three companies interviewed said that the ETS implemented since 2015 was an opportunity more seriously considering the environmental problems of the MCI. As the ETS has implemented, they should buy Certificated Emissions Reduction and responsible to reduce GHGs emission legally. The emission trading scheme is more rigorous than the GHGs energy target management system. It has imposed substantial costs and more stringent legal liability on MNOs.

E-wastes collection activities also showed a similar pattern of global regulations and domestic regulations. The European Union (EU) has discussed the Waste Electrical and Electronic Equipment (WEEE) Directive in 2003 and began to apply it to all members of states including the UK since 2006. According to the WEEE Directive, the manufacturer or distributor of the equipment required to be responsible for the disposal of electrical and electronic equipment (EU, 2003). Similarly, the Korean Ministry of Environment has been EPR since 2003, the policy has been applied to MNOs, in charge of handset distribution, since 2005 (Ministry of Environment, 2005). MNOs have had a legal responsibility to collect, recycle or dispose of discarded communications equipment or mobile phones.

In conclusion, the regulatory mechanism has affected the overall implementation of EM by Korean MNOs. It was also identified that these coercive mechanisms are stems not only from domestic regulations but also international standards.

5.2 Mimetic and Cognitive Mechanism

The mimetic/cognitive mechanism can be defined as copying other organizations'

practices (DiMaggio & Powell, 1983; Scott, 2001). The mimetic mechanism is prominent when uncertainty is high. The MCI has been applied to relatively less environmental regulations compared to other industries. However, they are not free from environmental pressures with rising of global interests in climate change. This context arises the uncertainty to conduct EM, hence the mimetic mechanism would work on MNOs' EM.

EM staffs of MNOs said that it is not easy to meet both the delivery of next-generation services and response to climate change. For instance, although efficiency and coverage of network equipment have got better than before, it needs to more relays or antennas to provide 5G mobile communications services stable. It would be led to release more GHGs from network equipment. Under these circumstances, MNOs will be not easy to determine the EM activities. Thus, MNOs' response to environmental issues, excluding development of new services and technologies, has remained at a level complied with relevant laws and regulations. Rather than proceeding with leading EM activities, they have maintained a level similar to competitors' EM activities based on mimetic mechanism.

The EM activities of MNOs in Korea were very similar. Internally, SKT, KT, and LGU+ have operated an environmental governance, organized green workplaces and conducted environmental education for internal employees. In the business area, they have made economic and environmental contributions through the transition to high-efficiency equipment and next-generation services such as IoT. They were alike too in terms of a collection of E-wastes, issuance of e-billing and mobile membership cards. In terms of reduction of social GHGs, they have operated navigation services that inform the shortest distance. It seems to mimic SKT's T map, the oldest and successful navigation service. SKT has acquired ISO 14001, the international environmental management system certification standard in 2012, and KT has certificated it in 2018.

The similar EM activities of MNOs have engendered comparable results. SKT was selected as the Carbon Disclosure Project (CDP) leader for four consecutive years by 2010-2013. KT was included in Carbon Management Honors Club at the 2016 CDP Award for 4 consecutive years. And LGU+ won the CDP sector winners award for the two consecutive years (2013-2014). And LGU+ was evaluated leadership A with

remarkable performances in terms of EM in 2016.

Meanwhile, KT and LGU+ actively have collaborated in jointly using low-power frequency to provide NB-IoT service, or jointly operate ONE NAVI service. The EM staff of one company said that these collaborations of two companies are the start of joint responsibility for climate change. The joint responses are likely to strengthen the EM of MNOs isomorphism by mimetic mechanism.

5.3 Normative Mechanism

The normative mechanism stems from norms that are prevalent in the environment where the organization belongs (DiMaggio & Powell, 1983). As mentioned in the CSM section, companies should consider economic sustainability as well as social and environmental sustainability. In general, companies aim to meet social expectations such as social responsibility and environmental contributions after achieved economic growth. Specifically, corporates what play a pivotal role in society such as the MNOs have been given more expectations and imposed responsibilities from diverse stakeholders including consumers, policymakers, civic organizations and so on.

Indeed, various normative factors have affected the EM activities of MNOs. In terms of the environment, it is highlighted the needs for the global response to climate change and MNOs are not free from these environmental pressures in a last decade. As the ‘low-carbon green growth’ was embraced in 2008 with the national vision of growth in Korea, the related promotion and regulation have begun in earnest. In 2011, the penetration rate of mobile communications service exceeded 100% (ITSTAT, 2011), whereby MNOs had to find the solution to reverse the decline.

In this business environment, MNOs have been focusing on developing IoT services that can help them to re-leap, while contributing to solving social and environmental problems. Currently, all three corporates are providing IoT services such as smart grid, smart home, smart energy, and smart city. The EM staffs of the MNOs said that they have considered the positive impacts of the environment and social aspects from the stage of designing the IoT service. They also argued that their expertise and innovation of IoT

services will make their EM more advanced and their social contribution will also increase. Through this, we could know that the normative mechanism has a great influence on MNOs' EM. The Table 2 showed the summary of the three MNOs' EM practice.

Table 2. Summary of Environmental Management

Environmental Management Issues	SKT	KT	LGU+	Institutional Mechanism
Environmental Communication	Operate EM governance			Regulatory Mimetic
	Green ICT Commitment	Energy management commitment	EM governance	
	Environmental Education			
	Education to employees	Education to employees / Support partners to gain ISO 14001	Education to employees / Participation in Green forum / Green consulting for partners	
	ISO 14001			
Environmental Social	Efforts to reduce social GHGs emission: Operating Navigation service			Regulatory Mimetic
	T map	ONE Navi		
Environmental Economic	E-billing / Eco-membership card			Regulatory Mimetic Normative
	Electronic bill conversion rate is 87% (2016)	Approximately 70% of subscribers use e-bills (2013) / Conduct E-bills conversion campaigns with environmental groups	Reduction of paper bills 37.3 million than 2011 in 2016 / Love delivered through the bill campaign	
	Mobile membership card issuance rate is 56% (2016)	Increasing mobile membership card application users	Approximately 4.7 million downloads of mobile membership apps (2016)	
	Efforts to reduce GHGs emission from network equipment			

	Technology development and facility investment to improve the efficiency of network equipment Improve efficiency of power consumption of network equipment / Convert to network integration and high-efficiency equipment / Establish GHGs inventory system / Introduction of outside air cooling		
		Operating Green IDC center	
	Invest in new technologies and IoT services		
	Smart grid (Building Energy Management System, Factory Energy Management System) / Smart Home / Smart city		
	KT-MEG / Renewal Energy Management System (REMS)	Providing Smart meter service with Korea Electric Power Corporation (KEPCO)	
	Foster eco-friendly office environment		
	Water saving and rainwater recycling / Efforts to reduce office wastes / Purchase high-efficiency lighting or electronics / Reduce paper usage		
	Use electric vehicles	Establish solar self-generation systems in its buildings	
	Use geothermal energy		
	Disposal of E-waste		
Environmental Social Economic	Green IT Campaign / Operate 'Happy Eco-phone foundation'	Green relay campaign with Industrial Bank of Korea	Regulatory Mimetic Normative
	Electromagnetic Wave emission from network equipment and devices		
	Comply with standard laws		
	Support research project on electromagnetic wave effect on the human body		

6. Conclusion

This study examined the environmental issues in the MCI on the integrated perspective of CSM and analyzed the Korean MNOs' EM based on the isomorphism framework of the institutional theory. The result of this study showed that there are a lot of environmental and economic issues. Korean MNOs have actively engaged in EM practices to cope with complex environmental issues in the MCI. The three mechanisms of the institutional theory have worked together in their EM.

This study provides several implications for policymakers, practitioners, and researchers. Implications for practitioners are following. First, environmental issues need to approach from the integrative framework. In the integrated report published by MNOs, the EM section has been discussed as non-financial factors or environmental factors only. Although we found the EM contents in financial and social section recently, there was a tendency to perceive it as a part of sustainability management rather than an integrated approach to CSM. Even one staff argued separation of CSM and EM. As discussed in this study, economic, social and environmental aspects must be taken into consideration at the same time to pursue CSM. EM will play a key role in achieving CSM considering all the three aspects; environmental, social and economic. Therefore, we recommend to MNOs that EM from an integrated CSM perspective.

Second, it is necessary to activate the EM more actively than now, although MNOs' EM has been evolved from the initial regulatory compliance level to participating voluntary corporate citizens. Porter and Linde (1995a; b) argued that EM is an effective way to strengthen competitive advantage and create shared value (CSV). Most of the environmental issues in the MCI were related to the economic and environmental domain, especially those related to next-generation mobile communications services. For example, IoT services such as Smart Grid and Smart City have sufficient potential to contribute not only to the competitive advantage and sustainability of companies but also to the achievement of social and environmental CSV. Thus, we suggest that applying MNOs' innovative services to EM to increase corporate value and make efforts to CSV.

For policymakers, this study proposes a more detailed environmental policy considering the characteristics of the industry. For example, E-waste from MCI has

focused on mobile phones but the types and scope of them will vary with smart speakers, smart appliances, and wearable appliances in the future. The current law, however, does not give any indication of the responsibility for the recovery or recycling of such diverse E-waste. In the case of a smart home, it is ambiguous to decide who should be responsible for the wastes generated during the build the environment included from a construction of smart apartment to manage appliances. Therefore, it needs professional and realistic environmental policies to cope with social changes due to technological development.

In addition, we recommend that encouraging spontaneous participation and preparing a reward system for environmental performance rather than compulsory regulation. The starting point of the MNOs' EM was a response to implementing the regulation, but as time passed, the normative mechanism was actively working. This can be interpreted as a sense of corporate responsibility for social needs. Emphasizing corporate social responsibility and encouraging voluntary participation can be a more effective way to induce corporate participation in improving environmental issues. One of EM managers said that even if we try to activate the more aggressive EM, we have remained in the level of compliance with the regulations because the investment is not well compensated. Thus, compensation policy to reflect MNOs' environmental and social contribution to the carbon emission trading scheme is likely to be useful to achieve a healthy green growth.

This study has academic contribution like following. We expanded the concept of CSM by applying the integrated CSM perspective to the environmental issues in MCI. We contributed to shed light on the MNOs' EM by enlarging the scope of research and investigating systematically. Despite this academic commitment, this study has a limitation that focused on only for Korean MNOs. Thus, we recommend conducting comparative studies with MNOs in other countries for future study.

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